



UNITED STATES PATENT AND TRADEMARK OFFICE

UNITED STATES DEPARTMENT OF COMMERCE
United States Patent and Trademark Office
Address: COMMISSIONER FOR PATENTS
P.O. Box 1450
Alexandria, Virginia 22313-1450
www.uspto.gov

APPLICATION NO.	FILING DATE	FIRST NAMED INVENTOR	ATTORNEY DOCKET NO.	CONFIRMATION NO.
10/776,394	02/11/2004	Heung-Jin Joo	5649-1258	3921
20792	7590	10/05/2005	EXAMINER	
MYERS BIGEL SIBLEY & SAJOVEC			QUACH, TUAN N	
PO BOX 37428			ART UNIT	
RALEIGH, NC 27627			PAPER NUMBER	
			2826	

DATE MAILED: 10/05/2005

Please find below and/or attached an Office communication concerning this application or proceeding.

Office Action Summary	Application No.	Applicant(s)	
	10/776,394	JOO ET AL.	
	Examiner	Art Unit	
	Tuan Quach	2826	

-- The MAILING DATE of this communication appears on the cover sheet with the correspondence address --
Period for Reply

A SHORTENED STATUTORY PERIOD FOR REPLY IS SET TO EXPIRE 3 MONTH(S) OR THIRTY (30) DAYS, WHICHEVER IS LONGER, FROM THE MAILING DATE OF THIS COMMUNICATION.

- Extensions of time may be available under the provisions of 37 CFR 1.136(a). In no event, however, may a reply be timely filed after SIX (6) MONTHS from the mailing date of this communication.
- If NO period for reply is specified above, the maximum statutory period will apply and will expire SIX (6) MONTHS from the mailing date of this communication.
- Failure to reply within the set or extended period for reply will, by statute, cause the application to become ABANDONED (35 U.S.C. § 133). Any reply received by the Office later than three months after the mailing date of this communication, even if timely filed, may reduce any earned patent term adjustment. See 37 CFR 1.704(b).

Status

- 1) ☒ Responsive to communication(s) filed on 13 September 2005.
- 2a) ☐ This action is FINAL. 2b) ☒ This action is non-final.
- 3) ☐ Since this application is in condition for allowance except for formal matters, prosecution as to the merits is closed in accordance with the practice under *Ex parte Quayle*, 1935 C.D. 11, 453 O.G. 213.

Disposition of Claims

- 4) ☒ Claim(s) 13-18 and 21-42 is/are pending in the application.
- 4a) Of the above claim(s) _____ is/are withdrawn from consideration.
- 5) ☒ Claim(s) 13-18, 21-25 and 29-31 is/are allowed.
- 6) ☒ Claim(s) 26-28, 32-37 and 39 is/are rejected.
- 7) ☒ Claim(s) 38 and 40-42 is/are objected to.
- 8) ☐ Claim(s) _____ are subject to restriction and/or election requirement.

Application Papers

- 9) ☐ The specification is objected to by the Examiner.
- 10) ☒ The drawing(s) filed on 11 February 2004 is/are: a) ☒ accepted or b) ☐ objected to by the Examiner.
 Applicant may not request that any objection to the drawing(s) be held in abeyance. See 37 CFR 1.85(a).
 Replacement drawing sheet(s) including the correction is required if the drawing(s) is objected to. See 37 CFR 1.121(d).
- 11) ☐ The oath or declaration is objected to by the Examiner. Note the attached Office Action or form PTO-152.

Priority under 35 U.S.C. § 119

- 12) ☒ Acknowledgment is made of a claim for foreign priority under 35 U.S.C. § 119(a)-(d) or (f).
- a) ☒ All b) ☐ Some * c) ☐ None of:
1. ☒ Certified copies of the priority documents have been received.
2. ☐ Certified copies of the priority documents have been received in Application No. _____.
3. ☐ Copies of the certified copies of the priority documents have been received in this National Stage application from the International Bureau (PCT Rule 17.2(a)).

* See the attached detailed Office action for a list of the certified copies not received.

Attachment(s)

- | | |
|--|---|
| 1) <input checked="" type="checkbox"/> Notice of References Cited (PTO-892) | 4) <input type="checkbox"/> Interview Summary (PTO-413) |
| 2) <input type="checkbox"/> Notice of Draftsperson's Patent Drawing Review (PTO-948) | Paper No(s)/Mail Date. _____ |
| 3) <input checked="" type="checkbox"/> Information Disclosure Statement(s) (PTO-1449 or PTO/SB/08) | 5) <input type="checkbox"/> Notice of Informal Patent Application (PTO-152) |
| Paper No(s)/Mail Date <u>9/13/05</u> | 6) <input type="checkbox"/> Other: _____ |

DETAILED ACTION

A request for continued examination under 37 CFR 1.114, including the fee set forth in 37 CFR 1.17(e), was filed in this application after allowance or after an Office action under *Ex Parte Quayle*, 25 USPQ 74, 453 O.G. 213 (Comm'r Pat. 1935). Since this application is eligible for continued examination under 37 CFR 1.114, and the fee set forth in 37 CFR 1.17(e) has been timely paid, prosecution in this application has been reopened pursuant to 37 CFR 1.114. Applicant's submission filed on September 13, 2005 has been entered.

The following is a quotation of 35 U.S.C. 103(a) which forms the basis for all obviousness rejections set forth in this Office action:

(a) A patent may not be obtained though the invention is not identically disclosed or described as set forth in section 102 of this title, if the differences between the subject matter sought to be patented and the prior art are such that the subject matter as a whole would have been obvious at the time the invention was made to a person having ordinary skill in the art to which said subject matter pertains. Patentability shall not be negated by the manner in which the invention was made.

This application currently names joint inventors. In considering patentability of the claims under 35 U.S.C. 103(a), the examiner presumes that the subject matter of the various claims was commonly owned at the time any inventions covered therein were made absent any evidence to the contrary. Applicant is advised of the obligation under 37 CFR 1.56 to point out the inventor and invention dates of each claim that was not commonly owned at the time a later invention was made in order for the examiner to consider the applicability of 35 U.S.C. 103(c) and potential 35 U.S.C. 102(e), (f) or (g) prior art under 35 U.S.C. 103(a).

Claims 26-28, 32-37 are rejected under 35 U.S.C. 103(a) as being unpatentable over Wang et al. '007 taken with Cerva et al.

Re claims 26-28, 32-37, Wang et al. (6,339,007) teaches forming a ferroelectric memory device comprising a lower insulating layer 21 including an conductive plug 22 on semiconductor substrate 20, forming oxygen diffusion barrier pattern 23 connected to the plug, forming upper insulating layer 26 on the lower insulating layer and surrounding the sidewalls of the oxygen barrier 23 and top surface of the insulating layer 26 is higher than a top surface of the oxygen-barrier pattern, forming a lower electrode layer 28 on the upper insulating layer pattern and the oxygen diffusion barrier pattern, forming a ferroelectric layer 30 on the lower electrode layer, forming an upper electrode layer 31 on the ferroelectric layer 30. See Figs. 1-6 and the substantially similar embodiment in Figs. 8-14, column 3 line 17 to column 4 line 61. Wang et al. lacks primarily the patterning of the lower electrode, the ferroelectric layer, the upper electrode is not taught.

Cervas et al. 6,790,676 B2 teaches forming lower electrode including layer 9, a dielectric film 10, and followed by upper electrode 13 wherein the three layers are structured or patterning using etching in the same step as in Fig. 8, column 4 line 57 to column 6 line 5.

It would have been obvious to one skilled in the art in practicing the above invention to have employed the patterning method taught by Cervas et al. since such is conventional and advantageous wherein the three layers can be patterned in the same step as taught by Cervas et al.

Re claim 27 the selection of suitable and conventional oxygen diffusion barrier materials and suitable combinations thereof would have been within the purview of one

skilled in the art, e.g., Wang et al. column 3 lines 29-45, consistent with disclosure at instant specification page 9 lines 16-20. Regarding claim 28, the use of suitable and conventional electrode material and suitable combination thereof would have been within the purview of one skilled in the art, e.g., as in Wang et al., column 3 lines 52-57, column 6 lines 58-62, consistent with the instant specification page 11 lines 2 et seq. Alternatively, official notice is given regarding such suitable and conventional materials and combinations thereof.

Claim 27 is rejected under 35 U.S.C. 103(a) as being unpatentable over Wang et al. '007 taken with Cervas et al. as applied to claims 26-28, 32-37 above, and further in view of Wang et al. '156 and Kim.

Regarding claim 27, in addition to the reasons delineated above, Wang et al. 6,933,156 further teaches conventional oxygen barrier, e.g., column 13 lines 35-62 the use of suitable noble metals as oxygen barrier. It would have been obvious to have employed the various materials and combination thereof in this claim for oxygen diffusion barrier since such corresponds to conventional materials as taught by both Wang et al. Although Wang et al. '007 does not recite identically the oxygen diffusion barrier is a single layer of iridium, or a double layer pattern of iridium and titanium aluminum nitride, or a triple layer patterned of iridium titanium aluminum nitride, and nitride, such would have been obvious as taught by Wang et al. '007, regarding the use of suitable and conventional electrode material and suitable combination thereof would have been within the purview of one skilled in the art, e.g., as in Wang et al. '007, column 3 lines 52-57, column 6 lines 58-62, consistent with the instant specification

page 9 line 16-20 wherein it evidences that the oxygen diffusion barrier can be material that can prevent oxygen diffusion and may comprise, for example, noble metals such as iridium, ruthenium, titanium aluminum nitride, titanium, etc., and maybe a single layer or multiple layer and maybe include one or more materials as examples, e.g., page 9 lines 27-31, and since such corresponds to conventional and suitable oxygen barriers as evidenced by Wang et al. '156 supra, column 13 lines 35-62, including the use of single layer of suitable noble metals such as iridium, or ruthenium, rhodium, or multiple layers and the use of multiple layers including suitable materials, including noble metals as taught by Wang et al. '156 and well known materials such as TiAlN as taught in Wang '007, column 3 line 29-30, or including further conventional conductive materials such as titanium, e.g., as evidenced by Kim 6,281,537, column 6 lines 46-65, including materials such as titanium, wherein the further inclusion of suitable conductive materials does not require any inventiveness.

Claim 39 is rejected under 35 U.S.C. 103(a) as being unpatentable over Wang et al. '007 taken with Wang et al. '156 and Kim.

Wang et al. (6,339,007) teaches forming a ferroelectric memory device comprising a lower insulating layer 21 including an conductive plug 22 on semiconductor substrate 20, forming oxygen diffusion barrier pattern 23 connected to the plug, providing hard mask layer 26 and patterning the layers to form barrier pattern connecting to conductive 22, forming upper insulating layer 26 on the lower insulating layer and surrounding the sidewalls of the oxygen barrier 23 and top surface of the insulating layer 26 is higher than a top surface of the oxygen-barrier pattern, removing

Art Unit: 2826

hard mask 26, forming a lower electrode layer 28 on the upper insulating layer pattern and the oxygen diffusion barrier pattern, forming a ferroelectric layer 30 on the lower electrode layer, forming an upper electrode layer 31 on the ferroelectric layer 30. See Figs. 1-6 and the substantially similar embodiment in Figs. 8-14, column 3 line 17 to column 4 line 61. Although Wang et al. does not recite identically the oxygen diffusion barrier is a single layer of iridium, or a double layer pattern of iridium and titanium aluminum nitride, or a triple layer patterned of iridium titanium aluminum nitride, and nitride, such would have been obvious as taught by Wang et al. '007, regarding the use of suitable and conventional electrode material and suitable combination thereof would have been within the purview of one skilled in the art, e.g., as in Wang et al. '007, column 3 lines 52-57, column 6 lines 58-62, consistent with the instant specification page 9 line 16-20 wherein it evidences that the oxygen diffusion barrier can be material that can prevent oxygen diffusion and may comprise, for example, noble metals such as iridium, ruthenium, titanium aluminum nitride, titanium, etc., and maybe a single layer or multiple layer and maybe include one or more materials as examples, e.g., page 9 lines 27-31, and since such corresponds to conventional and suitable oxygen barriers as evidenced by Wang et al. '156 supra, column 13 lines 35-62, including the use of single layer of suitable noble metals such as iridium, or ruthenium, rhodium, or multiple layers and the use of multiple layers including suitable materials, including noble metals as taught by Wang et al. '156 and well known materials such as TiAlN as taught in Wang '007, column 3 line 29-30, or including further conventional conductive materials such

as titanium, e.g., as evidenced by Kim 6,281,537, column 6 lines 46-65, wherein the further inclusion of suitable conductive materials does not require any inventiveness.

Claims 13-18, 21-25, 29-31 are allowed.

Claims 38 and 40-42 are objected to as being dependent upon a rejected base claim, but would be allowable if rewritten in independent form including all of the limitations of the base claim and any intervening claims.

The prior art does not appear to teach the formation of a third insulating layer after patterning the lower electrode, the ferroelectrode layer, the upper electrode layer that directly contacts sidewalls of the patterned layers thereof.

Any inquiry concerning this communication or earlier communications from the examiner should be directed to examiner Tuan Quach whose telephone number is 571-272-1717. The examiner can normally be reached on M-F from 8:30 AM to 4:30 PM.

If attempts to reach the examiner by telephone are unsuccessful, the examiner's supervisor Nathan Flynn, can be reached on 571-272-1915. The fax phone number for the organization where this application or proceeding is assigned is 703-872-9306.

Information regarding the status of an application may be obtained from the Patent Application Information Retrieval (PAIR) system. Status information for published applications may be obtained from either Private PAIR or Public PAIR. Status information for unpublished applications is available through Private PAIR only. For more information about the PAIR system, see <http://pair-direct.uspto.gov>. Should you have questions on access to the Private PAIR system, contact the Electronic Business Center (EBC) at 866-217-9197 (toll-free).


Tuan Quach
Primary Examiner